

WE CLAIM:

1. (currently amended) A router for a polarized light, comprising:  
an optical waveguide for guiding said polarized light;  
a magneto optic rotator (MOR) for controllably rotating a polarization angle of  
said polarized light; and  
a polarization beam splitter (PBS) seamlessly integrated into said optical  
waveguide for accepting said polarized light from said MOR, and routing said polarized  
light according to said polarization angle.

2. (original) The router of claim 1, wherein said MOR comprises:  
a first section, wherein in said first section a magnetic field is selectively switched  
between two modes, and wherein in said two modes said magnetic field has equal  
magnitudes and opposite directions, whereby in said first section said polarization angle  
is rotated by a fixed magnitude and selectively in opposing directions; and  
a second section following said first section, wherein in said second section a  
permanent magnetization prevails, whereby in said second section said polarization  
angle is rotated by a constant value.

3. (currently amended) The router of claim 2, wherein in said first section said fixed  
magnitude of said polarization angle rotation is approximately 45°, whereby said  
polarization angle in said first section is selectively rotated approximately by either + 45°  
or - 45°, and in said second section said constant value of said polarization angle  
rotation is approximately + 45°, whereby said polarization angle, upon said polarized  
light passing ~~through~~ through said first section and said second section, is selectively  
rotated approximately by either + 90° or by 0°.

4. (currently amended) The router of claim 2, wherein said first section and said second  
section[[s]] of said MOR are ~~waveguides~~, wherein ~~each of~~ integrated into said  
~~waveguides~~ optical waveguide, each comprising a magneto-optically active layer guiding  
said polarized light.

1 5. (currently amended) The router of claim 4, wherein said first section and said second  
2 section ~~waveguides~~ further comprising at least one additional optical layer, said  
3 additional optical layer interfacing with said magneto-optically active layer, wherein said  
4 additional optical layer having a lower refractive index than said magneto-optically active  
5 layer.

6. (canceled)

1 7. (original) The router of claim 4, wherein said magnetic field in said first section of said  
2 MOR is generated by a current flowing in a metallic strip, wherein said metallic strip  
3 substantially covering said first section.

1 8. (original) The router of claim 5, wherein said magneto-optically active layer  
2 comprising of Yttrium Iron Garnet (YIG), and said additional optical layer comprising  
3 Gadolinium Gallium Garnet (GGG).

9. - 11. (canceled)

1 12. (currently amended) The router of claim ~~[[11]]~~ 1, wherein said PBS is a vertical  
2 polarization grating etched into said optical waveguide network.

1 13. (currently amended) The router of claim ~~[[11]]~~ 1, wherein said PBS is a Brewster  
2 angle beam splitter etched into said optical waveguide network.

1 14. (currently amended) The router of claim ~~[[11]]~~ 1, wherein said PBS is a birefringent  
2 prism built into said optical waveguide network.

1 15. (currently amended) The router of claim ~~[[10]]~~ 1, wherein said PBS is having  
2 asymmetric waveguide output arms, wherein each of said waveguide output arms is  
3 capable of propagating light only with one predetermined polarization angle.

1 16. (currently amended) A routing method for a polarized light in an optical waveguide  
2 network comprising the steps of:  
3 controllably rotating a polarization angle of said polarized light in a magneto optic  
4 rotator (MOR), wherein said MOR being a segment of said optical waveguide; and  
5 accepting said polarized light from said MOR and routing said polarized light  
6 along an optical path ~~by a polarization beam splitter (PBS);~~ in accordance with said  
7 polarization angle with a polarization beam splitter (PBS) which is seamlessly integrated  
8 into said optical waveguide.

17. - 20. (canceled)

1 21. (currently amended) In an electronic processor comprising a plurality of processing  
2 units, an optical backplane, comprising:  
3 a network of optical waveguides, said optical waveguides guiding a polarized  
4 light;  
5 routers for said polarized light [[in]] at vertexes of said network of optical  
6 waveguides, each router comprising:  
7 (a) a magneto optic rotator (MOR) for controllably rotating a polarization angle of  
8 said polarized light;  
9 (b) a polarization beam splitter (PBS) for accepting said polarized light from said  
10 MOR, and routing said light according to said polarization angle, wherein said PBS is  
11 seamlessly integrated into said optical waveguides; and  
12 optical devices for operationally connecting said processing units of said  
13 electronic processor to said network, wherein said network affords an optical  
14 interconnection amongst said processing units.

1 22. (original) The optical backplane of claim 21, wherein said optical waveguides are  
2 planar waveguides.

1 23. (original) The optical backplane of claim 21, wherein said optical waveguides are  
2 strip waveguides.

1 24. (original) The optical backplane of claim 21, wherein said optical waveguides are  
2 cylindrical waveguides.

25. (canceled)

1 26. (currently amended) The optical backplane of claim [[25]] 21, wherein in each of said  
2 routers for said polarized light said MOR comprising:

3 a first section, said first section comprising a magneto-optically active Yttrium  
4 Iron Garnet (YIG) layer guiding said polarized light, and a Gadolinium Gallium Garnet  
5 (GGG) layer interfacing with said YIG layer, wherein said GGG layer having a lower  
6 refractive index than said YIG layer, said first section further comprising a metallic strip,  
7 wherein said metallic strip substantially covering said first section, wherein a current  
8 flowing in said metallic strip generating a magnetic field in said first section, wherein said  
9 magnetic field being selectively switched between two modes, and wherein in said two  
10 modes said magnetic field has equal magnitudes and opposite directions, whereby in  
11 said first section said polarization angle is selectively rotated approximately by either +  
12 45° or - 45°; and

13 a second section following said first section, wherein said second section  
14 comprising a second magneto-optically active YIG layer guiding said polarized light,  
15 and a second GGG layer interfacing with said second YIG layer, wherein said second  
16 GGG layer having a lower refractive index than said second YIG layer, and wherein in  
17 said second section a permanent magnetization prevails, whereby in said second  
18 section said polarization angle is rotated by approximately + 45°, whereby said  
19 polarization angle, upon said polarized light passing trough said first section and said  
20 second section, is selectively rotated approximately by either + 90° or by 0°.

27. (canceled)

1 28. (original) The optical backplane of claim 21, wherein said network of optical  
2 waveguides comprising a doped SiO<sub>2</sub> layer guiding said polarized light, and an undoped  
3 SiO<sub>2</sub> layer interfacing with said doped SiO<sub>2</sub> layer, wherein said undoped SiO<sub>2</sub> layer

1. having a lower refractive index than said doped SiO<sub>2</sub> layer.

29. - 30. (canceled)

1 31. (currently amended) The optical backplane of claim ~~[[25]]~~ 21, wherein said PBS is  
2 having asymmetric waveguide output arms, wherein each of said waveguide output  
3 arms is capable of propagating light only with one predetermined polarization angle.

1 32. (currently amended) The optical backplane of claim ~~[[25]]~~ 21, wherein said optical  
2 devices for operationally connecting said processing units comprise a prism coupling  
3 optics.

1 33. (currently amended) The optical backplane of claim ~~[[25]]~~ 21, wherein said optical  
2 devices for operationally connecting said processing units comprise a grating coupling  
3 optics.

1 34. (original) The optical backplane of claim 26, wherein said first section and said  
2 second section of said MOR, and said network of optical waveguides are being  
3 seamlessly meshed together into a coplanar configuration.

1 35. (original) The optical backplane of claim 26, wherein said first section and said  
2 second section of said MOR are external to said network of optical waveguides, and  
3 wherein said first and second sections are grating coupled to said network of optical  
4 waveguides.

36. (canceled)

1 37. (currently amended) A method for providing an optical interconnection amongst  
2 processing units of an electronic processor using an optical backplane, comprising the  
3 steps of:

4 guiding a polarized light in ~~[[an]]~~ a network of optical waveguides network;

1 routing said polarized light [[in]] through vertexes of said network of optical  
2 waveguides by controllably rotating a polarization angle of said polarized light using a  
3 magneto optic rotator (MOR) and accepting said polarized light from said MOR and  
4 routing said light along an optical path in accordance with said polarization angle by a  
5 polarization beam splitter (PBS) which is seamlessly integrated into said optical  
6 waveguides network; and  
7 operationally connecting said processing units of said electronic processor to  
8 said network of optical waveguides by optical devices.

38. - 42. (canceled)

1 43. (new) The optical backplane of claim 21, wherein said PBS is a vertical polarization  
2 grating etched into said optical waveguides.

1 44. (new) The optical backplane of claim 21, wherein said PBS is a Brewster angle  
2 beam splitter etched into said optical waveguides.

1 45. (new) The optical backplane of claim 21, wherein said PBS is a birefringent prism  
2 built into said optical waveguides.

1 46. (new) The method for providing an optical interconnection of claim 37, further  
2 comprising the step of selecting said MOR to seamlessly mesh together with said optical  
3 waveguides into a coplanar configuration.

1 47. (new) In an electronic processor comprising a plurality of processing units, an optical  
2 backplane, comprising:

3 a network of optical waveguides for guiding a polarized light of a plurality of  
4 wavelengths;

5 a plurality of magneto optic rotators (MOR) for controllably rotating a polarization  
6 angle of said polarized light in vertexes of said network of optical waveguides, wherein  
7 said plurality of MOR are grating connected to said network of optical waveguides,

1 wherein each of said plurality of wavelengths is individually grating coupled to one MOR  
2 of said plurality of MOR, each MOR comprising:

3 (a), a first section, said first section comprising a magneto-optically active Yttrium  
4 Iron Garnet (YIG) layer guiding said polarized light, and a Gadolinium Gallium Garnet  
5 (GGG) layer interfacing with said YIG layer, wherein said GGG layer having a lower  
6 refractive index than said YIG layer, said first section further comprising a metallic strip,  
7 wherein said metallic strip substantially covering said first section, wherein a current  
8 flowing in said metallic strip generating a magnetic field in said first section, wherein said  
9 magnetic field being selectively switched between two modes, and wherein in said two  
10 modes said magnetic field has equal magnitudes and opposite directions, whereby in  
11 said first section said polarization angle is selectively rotated approximately by either +  
12 45° or - 45°;

13 (b), a second section following said first section, wherein said second section  
14 comprising a second magneto-optically active YIG layer guiding said polarized light,  
15 and a second GGG layer interfacing with said second YIG layer, wherein said second  
16 GGG layer having a lower refractive index than said second YIG layer, and wherein in  
17 said second section a permanent magnetization prevails, whereby in said second  
18 section said polarization angle is rotated by approximately + 45°, whereby said  
19 polarization angle, upon said polarized light passing through said first section and said  
20 second section, is selectively rotated approximately by either + 90° or by 0°;

21 a plurality of polarization beam splitters (PBS) for accepting said polarized light  
22 from said plurality of MOR, and routing said light according to said polarization angle;  
23 and

24 optical devices for operationally connecting said processing units of said  
25 electronic processor to said network, wherein said network affords an optical  
26 interconnection amongst said processing units.

27 48. (new) The optical backplane of claim 47, wherein said optical waveguides are planar  
28 waveguides.

1 49. (new) The optical backplane of claim 47, wherein said optical waveguides are strip  
2 waveguides.

1 50. (new) The optical backplane of claim 47, wherein said optical waveguides are  
2 cylindrical waveguides.

1 51. (new) The optical backplane of claim 47, wherein said network of optical waveguides  
2 comprising a doped  $\text{SiO}_2$  layer guiding said polarized light, and an undoped  $\text{SiO}_2$  layer  
3 interfacing with said doped  $\text{SiO}_2$  layer, wherein said undoped  $\text{SiO}_2$  layer having a lower  
4 refractive index than said doped  $\text{SiO}_2$  layer.

1 52. (new) The optical backplane of claim 51, wherein said network of optical waveguides  
2 further comprising a third optical layer in a sandwich structure, wherein said doped  $\text{SiO}_2$   
3 layer being disposed between said undoped  $\text{SiO}_2$  layer and said third optical layer,  
4 wherein said third optical layer having a lower refractive index than said doped  $\text{SiO}_2$   
5 layer.

1 53. (new) The optical backplane of claim 47, wherein said PBS is seamlessly integrated  
2 into said optical waveguides.

1 54. (new) The optical backplane of claim 53, wherein said PBS is a vertical polarization  
2 grating etched into said optical waveguides.

3 55. (new) The optical backplane of claim 53, wherein said PBS is a Brewster angle  
4 beam splitter etched into said optical waveguides.

5 56. (new) The optical backplane of claim 53, wherein said PBS is a birefringent prism  
6 built into said optical waveguides.

7 57. (new) The optical backplane of claim 53, wherein said PBS is having asymmetric  
8 waveguide output arms, wherein each of said waveguide output arms is capable of



1 propagating light only with one predetermined polarization angle.

2 58. (new) The optical backplane of claim 47, wherein said optical devices for  
3 operationally connecting said processing units comprise a prism coupling optics.

1 59. (new) The optical backplane of claim 47, wherein said optical devices for  
2 operationally connecting said processing units comprise a grating coupling optics.

3 60. (new) A method for providing an optical interconnection amongst processing units  
4 of an electronic processor using an optical backplane, comprising the steps of:  
5 guiding a polarized light of a plurality of wavelengths in an network of optical  
6 waveguides;

7 routing said polarized light through vertexes of said network of optical  
8 waveguides by controllably rotating a polarization angle of said polarized light using a  
9 plurality of magneto optic rotators (MOR) which are connected to said network of optical  
10 waveguides by gratings, and coupling each of said plurality of wavelengths by said  
11 gratings to a corresponding MOR of said plurality of MOR, and accepting said polarized  
12 light from said MOR and routing said light along an optical path by a polarization beam  
13 splitter (PBS), in accordance with said polarization angle, wherein said controllable  
14 rotation of said polarization angle in each of said MOR comprises the steps of:

15 (a) using a first section, said first section comprising a magneto-optically active  
16 Yttrium Iron Garnet (YIG) layer guiding said polarized light, and a Gadolinium Gallium  
17 Garnet (GGG) layer interfacing with said YIG layer, wherein said GGG layer having a  
18 lower refractive index than said YIG layer, and selectively switching a magnetic field  
19 between two modes in said first section, wherein in said two modes said magnetic field  
20 has equal magnitudes and opposite directions, wherein in said first section said  
21 polarization angle is rotated approximately by either + 45° or by - 45°, and creating and  
22 switching said magnetic field by switching a current in a metallic strip which is  
23 substantially covering said first section;

24 (b), using a second section following said first section, wherein said second  
25 section comprising a second magneto-optically active YIG layer guiding said polarized  
26 light, and a second GGG layer interfacing with said second YIG layer, wherein said

1 second GGG layer having a lower refractive index than said second YIG layer, and  
2 rotating said polarization angle by approximately  $+45^\circ$  by prevailing a permanent  
3 magnetization in said second section, wherein upon said polarized light passing through  
4 said first section and said second section it is selectively rotated approximately by either  
5  $+90^\circ$  or by  $0^\circ$ ; and

6 operationally connecting said processing units of said electronic processor to  
7 said network of optical waveguides by using optical devices.

1 61. (new) The method for providing an optical interconnection of claim 60, further  
2 comprising the step of selecting said PBS to seamlessly integrate into said optical  
3 waveguides.